THE FEEDING HABITS OF OVERWINTERING LARVAE OF *ETAINIA SPHENDAMNI* (HERING, 1937) (LEP.: NEPTICULIDAE)

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From the middle of the nineteenth century when *Etainia sericopeza* (Zeller) and *E. sphendamni* (Hering) were regarded as a single species under the former name, the two generations of larvae that fed in the keys of maple in May-June and July-August were well known. Mystery, however, surrounded a third generation which appeared on the trunks of the host tree in April and there spun their cocoons. Wocke (1871) seems to have been the first to suggest that these larvae had fed in the keys in the autumn and then overwintered in hibernacula. This theory was widely accepted. Trägårdh (1913, English summary) wrote, "All investigators agree that the larvae hybernate and to all appearance not in the definitive cocoons but in temporary ones; where the hybernation takes place is, however, not known". Ford (1949), and Emmet (1976b) for *E. sphendamni*, concurred with this view.

Hering (1937) recognised that there were two species and that *E. sericopeza* was host-specific to Norway maple *(Acer platanoides)* and the newly named *E. sphendamni* to field maple *(A. campestre)*. Jäckh (1951) gave the first description of the winter-feeding larvae of the former species, stating that they mined successively the base of a leaf-stalk, the bark of a twig and a developing flower-bud. When Paul Johnson and I made the first British record of *E. sericopeza sensu stricto*, we redescribed the life history of the winter-feeding generation from our own observations (Emmet & Johnson, 1977). We also made the following statement: "We think it likely that the full life histories of *E. sphendamni* and *E. decentella* are not yet known. The current doctrine, repeated by authors for over a century though apparently without positive evidence, is that the larvae which spin cocoons on the trunks in the spring mined the samaras in the previous autumn, and overwintered up the tree in hibernacula. On the analogy of *E. sericopeza*, it seems to us more likely that these species, likewise, have an overwintering generation of larvae feeding in the buds or some other part of their host tree; the larvae come down to pupate immediately on quitting their feeding place. Here is an interesting field for future research".

Accordingly, in April, 1978 I studied a local colony of *E. sphendamni*, looking for larvae feeding in a similar manner to those of *E. sericopeza*, but met with a complete lack of success; there were no discoloured or aborted buds containing either larvae or tell-tale frass. After this failure I abandoned the quest but not my opinion.

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I wrote in *The Field Guide* under this species "The life history of the winter generation of larvae is imperfectly known" (Emmet, 1979).

The discovery of an exceptionally populous colony of *E. sphendamni* at Chigborough Lakes Nature Reserve near Maldon, Essex (Emmet, 1983) prompted a renewed attempt. My wife and I had planned to visit the reserve on the 11th of April but postponed the journey on finding that the maple buds round our home in Saffron Walden had not yet started to swell as a result of the exceptionally cold spring. We considered that lack of difference between mined and therefore aborted buds and those that were healthy and expanding would make the detection of larvae too difficult. With hindsight we can see that this apparently sound reasoning was the cause of our failure in 1978. When we did go on the 20th of April, we were accompanied by Dr. John Langmaid who played a key role in solving the mystery.

We spent about 20 minutes searching for discoloured or aborted buds without finding any positive evidence of larval feeding. However, many of the buds were missing, leaving only the scars to show where they had dropped off. On some twigs as many as seven out of nine buds had gone, on others three or four and on others again all were present. The uneven incidence of this damage suggested larval feeding rather than weather as the cause but there was no proof that this was the case. Further defeat was looming when JL noticed a nepticulid larva suspended from a twig by a silken thread; one of the buds on this twig had an exit-hole at its base. The bud broke off at a touch and was seen to be full of frass. We found no more larvae whilst still in the field but a twig in a handful which we brought home bore a bud which proved to be tenanted by a second larva. Significantly, there was no outward evidence of the feeding. The first larva had been placed in a glass tube. Other commitments prevented examination before the next morning, when it was found to have completed its cocoon. The second larva fed on for a further 48 hours before spinning up. We were probably a fortnight too late for the majority of the larvae.

Our research has confirmed that *E. sphendamni* has an overwintering generation of larvae feeding in the buds of field maple in much the same manner as *E. sericopeza* on Norway maple. There are, however, significant differences. Norway maple comes into leaf and flower earlier than field maple. The larvae of *E. sericopeza* feed in the flower buds, aborting them and thereby rendering them conspicuous. The mined bud does not fall and is often chosen as the site for pupation. In spite of the difference in the timing of the vegetative development of the two species of maple, *E. sphendamni* seems to feed earlier. It shows no preference for flower buds and completes its growth in the still dormant buds. Each larva needs several of these very small buds and apparently passes exter-

nally from one to another, since there is no gallery in the twig. *E. sericopeza* is likewise capable of free transition between buds (Emmet & Johnson, *loc. cit.*), but this will happen less often since the buds of Norway maple are so much larger. *Etainia* appears to be the only European genus of the Nepticulidae with larvae capable of such external movement. On field maple the buds fall soon after they have been vacated, taking with them all evidence of larval feeding; this explains why 112 years elapsed before the problem posed by Wocke was solved. When a larva enters a new bud, its period of tenancy is short: it has moved on and the bud has dropped before any colour change takes place. It is unlikely that *E. sphendanni* ever spins its cocoon on the mined bud; if it did so, the cocoon would fall with the bud and be lost to the collector.

In all three species of *Etainia* many of the larvae descend to the ground by a silken thread and spin up where they drop. If a larva has fed high up, when it descends to pupate it may get blown against a trunk and it is then that the spinning takes place on that surface. The larva found hanging at Chigborough Lakes was placed in a dry glass tube without any vegetable matter. Its cocoon was pure white and remained so for a week. Then I placed a fresh young hawthorn leaf in the tube and when I looked again after two hours the cocoon had already turned dark brown. The other larva was in a plastic box containing twigs and buds and its cocoon was brown when first observed. A similar colour change was observed in the cocoons of *E. sericopeza* (Emmet & Johnson, *loc. cit.*) and in the larval case of *Coleophora tamesis* Waters (Emmet, 1970a). I am not aware that any study has been made of this reaction. The period spent in the cocoon (prepupa + pupa) was 20 days.

Our knowledge of the overwintering generation of *E. sphendanni* is still incomplete. It is possible that some larvae feed up during autumn in the keys, over-winter as pupae and emerge in spring simultaneously with the adults from the bud-feeding larvae. Warren (1881) observed oviposition taking place in mid-September on keys that were still green. Trägårdh (*loc. cit.*, English summary) wrote, "Larvae were found as late as 17-19 October and at the same time pupae, some of which were obtained from cocoons on leaves already fallen to the ground. It can consequently be no doubt that at least some hybernate in definitive cocoons which are spun on the leaves and with these drop to the ground" *[sic.]*. It would be interesting to know whether these autumn larvae belong to the same generation as those which will feed in the buds early in the following spring.

Reference has already been made to Jäckh's statement that the winter larvae of *E. sericopeza* mine petioles and bark before entering the buds. Paul Johnson and I failed to find any evidence of this, either through defective observation or because such feeding

is not obligatory and did not occur in the colony we were studying. It is possible that the winter larvae of *E. sphendamni* are part-fed before they enter the buds. If so, where did the earlier feeding take place? It could have been in the samaras.

The question arises of the feeding of the early generation of *E. decentella* (Herrich-Schäffer) which also has larvae which spin their cocoons on trunks in spring. Almost certainly they have fed in a manner similar to the related species. *E. decentella* feeds on sycamore *(A. pseudoplatanus).* Obviously the tree must be sufficiently mature to bear fruit for the summer generations to feed on; this means that it is tall and almost all branches are out of reach, rendering searching difficult. However, Johnson (1982) found a sycamore with low shoots bearing buds which had been mined, in all probability by *E. decentella.*

There may also be implications for other nepticulid species having their life histories still unknown. *Bohemannia* Stainton and *Etainia* Beirne are now placed next to each other (Bradley & Fletcher, 1979) because of the morphological similarities of the adults. There may also be resemblances in larval behaviour. *Bohemannia quadrimaculella* (Boheman) has always been associated with alder *(Alnus glutinosa)* and is not uncommon; nevertheless, its life history remains stubbornly undescribed. I once beat a pair *in cop.* from a branch of alder. Thinking that mating might be taking place before the female had flown, I searched for signs of larval feeding and found a bud which had been mined (Emmet, 1970b). At that time I knew nothing about the winter-feeding habits of *Etainia* and the concept of a nepticulid mining a bud was too novel to be readily acceptable. Now I feel with much more confidence that the mine I found was the work of *B. quadrimaculella.*

Ectoedemia bradfordi Emmet is known only from two specimens, one from the type locality in Kent and the other from Holland. Van Nieukerken (1982) suggests that it belongs to *Bohemannia* rather than *Ectoedemia* and may be a shoot-, bark- or bud-miner. Its apparent rarity may be due to our ignorance of its life history. The first specimen was taken on a leaf of wild service-tree *(Sorbus torminalis)* but this cannot be the foodplant as it does not occur in Holland.

Trifurcula pallidella Zeller has long been associated with dyer's greenweed *(Genista tinctoria)*, in all probability correctly. Bankes had a colony near his home in Dorset and repeatedly looked for the mine (unpublished diary in British Museum (Natural History)). My search for it in the bark resulted in the discovery that *Leucoptera spartifoliella* (Hubner) (Lyonetiidae) mines in the bark of this foodplant as well as of broom *(Sarothamnus scoparius)* (Emmet, 1976a). If the larva of *T. pallidella* is a bud-miner and the vacated

buds fall as easily as those mined by *E. sphendanni* do from field maple, it would be just as elusive as the winter-feeding larva of the latter species.

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